

**APPARATUS AND METHOD FOR MERGING WIRELESS TELEPHONE  
SERVICE WITH EXISTING WIRED TELEPHONE EQUIPMENT IN A  
FACILITY**

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**BACKGROUND OF THE INVENTION**

**1. Technical Field:**

The present invention is directed to an apparatus and method for merging wireless telephone service with 10 existing wired telephone equipment in a facility.

**2. Description of Related Art:**

Mobile, also called wireless, telephones are becoming more prevalent in today's society. Many 15 households have at least one mobile telephone and many businesses now issue wireless telephones to their employees. However, the mobile phone and phones used within the home or business facilities are rarely the same. Moreover, the mobile phone typically has a 20 different telephone number than the telephones in the home or business facilities. For example, a telephone service subscriber may have a first telephone number assigned to the land-line telephones in his/her home and a second telephone number assigned to his/her mobile 25 telephone.

Thus, telephone service subscribers must pay for two separate telephone subscriptions and cope with having two different telephone numbers. Furthermore, the persons that will attempt to contact the subscriber must be made 30 aware of both telephone numbers and often must try both telephone numbers when attempting to contact the subscriber.

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Many subscribers would prefer to use their mobile telephones everywhere and discontinue their subscriptions to wired telephone service. There are many reasons why users may prefer to use their mobile telephones. First,  
5 many services that have extra fees associated with them in a wired telephone service are free with mobile telephone service subscriptions, including CallerID and VoiceMail. Second, the cost of usage may, depending on the mobile telephone service subscription plan, be less  
10 than that of wired service.

On the other hand, with wired telephone service, many wired telephones may be connected and use the same telephone number with no additional cost. In addition wire telephone units are typically cheaper than mobile  
15 telephones (unless they are purchased through special incentive offers provided by mobile telephone service providers). Thus, it would be beneficial to have an apparatus and method for merging mobile telephone service with existing wired telephone service equipment in  
20 facilities.

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**SUMMARY OF THE INVENTION**

An apparatus and method for merging mobile, or wireless, telephone service with existing wired telephone equipment in a facility, such as a home or business, are provided. With the apparatus and method, a converter is associated with the facility such that a wireless telephone number is associated with the converter. Telephone calls may be made to the facility via a wireless telephone network and the converter.

The converter receives calls from the wireless telephone network directed to the converter, converts the format of the wireless telephone call to a wired telephone call format, and routes these calls to one or more wired telephone units in the facility. Calls originating from the wired telephone units in the facility are received by the converter which converts the call signals to an appropriate format for wireless network routing, and forwards the call to the wireless network.

In an alternative embodiment, a single telephone number may be associated with a converter and with one or more wireless telephones. When a call is received and is directed to the telephone number, the telephone call is routed to both the wireless telephone and the converter. The converter operates in the same manner as in the previous embodiment. The wireless telephone operates in a normal fashion. The telephone that first answers the call receives the call signals and the routing of the call to the other telephones is discontinued.

In addition, the wireless telephone may be equipped with a location determination device that determines the

wireless telephone's geographic location. This geographic location may be reported to the wireless service provider. When a call is received for the telephone number associated with the wireless telephone  
5 and the converter, a check is made to determine if the last reported location of the wireless telephone was the location of the facility associated with the converter. If the last reported location was the same as the facility location, calls are not routed to the wireless  
10 telephone and are only routed to the wired telephone units via the converter.

Alternatively, telephone calls may be routed to both the converter and the wireless telephone. In such an embodiment, both the converter and the wireless telephone  
15 have an electronic ID (EID), mobile identification number (MIN), or the like. A single telephone number will have the two EIDs associated with it. When a call is placed to the telephone number, the call will be sent to both EIDs and thus, both the converter and the wireless  
20 telephone. Other features and advantages of the invention will be described in, or will become apparent to those of ordinary skill in the art in view of, the following detailed description of the preferred embodiments.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

10       **Figure 1** is an exemplary block diagram illustrating a telephone network according to the present invention;

**Figure 2** is an exemplary diagram illustrating a wireless to wired telephone converter according to the present invention;

15       **Figure 3A** is a flowchart outlining an exemplary operation of the present invention when receiving a call from a wireless network;

**Figure 3B** is a flowchart outlining an exemplary operation of the present invention when receiving a call 20 from a facility wired telephone;

**Figure 4** is an exemplary block diagram illustrating a telephone network in accordance with a second exemplary embodiment of the present invention;

25       **Figure 5** is an exemplary block diagram of a wireless service provider according to the second exemplary embodiment; and

**Figure 6** is a flowchart outlining an exemplary operation of the second exemplary embodiment of the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

**Figure 1** is an exemplary block diagram of a telephone network in accordance with the present invention. As shown in **Figure 1**, the telephone network **100** includes a wireless network **110**, a wireless service provider **115**, a converter **120** and a facility **130** having one or more wired telephone units **140-160**. The wireless network **110** may be a cellular network, satellite network, infrared network, Bluetooth™ network, or the like. The wireless network **110** may include a plurality of routers, switches, base stations, and the like. Moreover, the wireless network **110** may include one or more wireless networks of the same or different types. The wireless network **110** operates in the same manner as generally known in the art.

The wireless service provider **115** provides wireless telephone services to the facility **130** via the converter **120**. The wireless service provider **115** may operate in the same manner as generally known in the art with regard to providing wireless telephone service to wireless telephone devices. In the present invention, the converter **120** is considered a wireless telephone device by the wireless service provider **115** and thus, the wireless service provider **115** routes wireless telephone calls to the converter **120** in much the same way that known wireless service providers route wireless telephone calls to wireless telephone devices.

In an alternative embodiment, as described in more detail hereafter, the wireless telephone service provider may have its operation modified from that generally known

of existing wireless telephone service providers, such that the wireless telephone service provider determines whether to route wireless telephone calls to a wireless telephone unit and/or the converter **120** based on its  
5 current location.

The converter **120** couples the wireless network **110** to the facility **130** and facilitates the merging of wireless telephone service with the wired telephone equipment in the facility **130**. The converter **120**

10 converts wireless call signals received from the wireless telephone service provider **115** into a format useable by the wired telephone units **140-160** associated with the facility **130**. The converter **120** then routes the call to the wired telephone units **140-160**.

15 Conversely, the converter **120** may receive telephone call signals from wired telephone units **140-160** and convert them to a wireless network format. The converter **120** may then route the call signals to the wireless telephone service provider **115** for routing through the  
20 wireless network **110** to the designated destination.

When a call is received by the converter **120** from the wireless network **110**, the call is converted to a format usable by wired telephone devices **140-160**. Such conversion is performed in a manner generally known in  
25 the art for sending mobile telephone calls to land-line telephones. The conversion may include converting signaling protocols used by the wireless network to signaling protocols used by wired networks, for example. In the present case, however, the call is not routed  
30 through an external wired telephone network to arrive at the facility telephone units **140-160** but rather, is

Docket No. AUS920010578US1

routed to the converter **120** via the wireless network **110** and then from the converter **120** to the wired telephone units **140-160**.

Once the converter **120** converts the call to a wired  
5 telephone network protocol, the converter **120** forwards  
the call to one or more of the wired telephone units  
**140-160** associated with the facility **130**. Such  
forwarding causes the wired telephone units **140-160** to  
which the call is forwarded to ring to thereby notify  
10 persons nearby that a telephone call is available to be  
received.

In this way, the wired telephone units **140-160** are  
operated in a normal fashion as if the call were routed  
through a wired telephone network. Thus, the recipient  
15 of telephone call is not aware of any difference in the  
telephone service that they receive. Similarly, the  
calling party places a call in the same fashion as they  
would without the presence of the present invention. The  
present invention operates as a bridge between the  
20 wireless network **110** and the facility **130** such that  
telephone service may be provided by a wireless telephone  
service provider to a wired telephone in the facility **130**  
with little if any difference in the operating experience  
of the caller and the call recipient.

25 In addition to the above, in forwarding the call to  
the wired telephone units **140-160**, any special telephone  
services subscribed to by the wireless subscriber at the  
facility **130** will be provided in the forwarding of the  
call. Thus, for example, if the subscriber's wireless  
30 telephone service subscription includes a voicemail  
service and a caller ID service, such services will be  
provided to the wired telephone units **140-160**, assuming

the wired telephone units **140-160** are equipped to make use of such services. As a result, many services that do not require an additional charge in the mobile telephone service subscription are provided to wired telephone

5 units without requiring an additional cost.

If the wired telephone units **140-160** are not equipped to make use of the wireless telephone services, the wired telephone units may be provided with a separate device coupled to the wired telephone unit **140-160** that

10 provides the necessary functionality. For example, as shown in **Figure 1**, the wired telephone unit **140** may be provided with a wireless services unit **180** that provides one or more interfaces, circuitry, and applications for providing wireless telephone services to the wired

15 telephone unit **140**. Thus, when the converter **120** forwards the call to the wired telephone unit **140**, the call is passed through the wireless services unit **180** which provides any wireless services identified in the call signals. Thus, even wired telephone units that are 20 not equipped to handle wireless telephone services may be provided with these services with the aid of an additional hardware unit.

When placing an outbound call, a calling party may make use of a wired telephone unit **140-160** in the facility **130** in a normal manner. The calling party dials the telephone number and awaits being connected to the called party. The converter **120** receives the initiation call signals from the wired telephone unit and converts them to a format useable with the wireless telephone 30 network **110**. The converter **120** then forwards the call to the wireless network **110** which then routes the call in a

normal fashion to the destination telephone unit (either wired or wireless).

Moreover, while the present invention is being described in terms of a single telephone number being associated with the converter **120**, the present invention is not limited to such. Rather, multiple telephone numbers may be associated with a single converter **120**. This may be the case in a business type facility **130**, where there may be a plurality of different offices or the like, each may have their own telephone number.

In such a case, the wireless service provider **115** will route all calls to any of the telephone numbers associated with the facility **130** to the converter **120**. The converter **120** may then store a table identifying which wired telephone units **140-160** correspond to different destination telephone numbers. Based on the destination telephone number of the call that was received, as may be determined, for example, based on header information or header signals, the converter **120** may identify the appropriate destination wired telephone unit **140-160** to which the call should be forwarded. The call is then forwarded to the wired telephone unit **140-160** based on this table look-up.

**Figure 2** is an exemplary block diagram of a converter according to the present invention. As shown in **Figure 2**, the converter **200** includes a controller **210**, a memory **220**, a facility wired network interface **230**, and a wireless network interface **240**. The elements **210-240** are coupled to one another via the control/data signal bus **250**. Although a bus architecture is shown in **Figure 2**, the present invention is not limited to such and any

architecture that facilitates the communication of control/data signals among the elements **210-240** may be used without departing from the spirit and scope of the present invention.

5       The controller **210** controls the overall operation of the converter **200** based on control programs stored in the memory **220**. The controller **210** operates to convert calls from a mobile network format to a wired telephone format, and vice versa, so that calls may be made to and from the  
10      wired telephone units associated with the facility to which the converter **200** is assigned. In addition, the controller **210** may use a lookup table in the memory **220** to identify to which one of the wired telephone units to forward the call based on the destination telephone  
15      number of the received call.

      The facility wired network interface **230** provides a communication interface for sending and receiving calls to and from wired telephone units associated with the facility. The wireless network interface **240** provides a  
20      communication interface for sending and receiving calls to and from wireless telephone units via the wireless network **110**, for example. The wireless network interface **240** may include, for example, a transceiver through which calls are sent and received in a wireless manner.

25       In addition to providing a gateway through which calls to a wireless telephone number may be routed to land-line telephones in a facility, the converter of the present invention may also keep track of the calls to and from each existing wired telephone, keep track of which  
30      telephone in the building the call was sent to or from, store telephone preferences for each wired telephone, user preferences for each user of the wired telephones,

store data regarding the telephone capabilities, maintain billing records, and the like. The converter may be provided with data storage devices and applications for providing these functions.

5       **Figure 3A** is a flowchart outlining an exemplary operation of the present invention when receiving a call from a wireless network. As shown in **Figure 3A**, the operation starts with the receipt of a call from a wireless network device (step **310**). The call is  
10 converted from the wireless network format to a wired network format (step **320**) and then routed to one or more of the wired telephone units in the facility (step **330**). Such routing of the call to a wired telephone unit in the facility may include a table look-up based on the  
15 destination telephone number as previously described.

**Figure 3B** is a flowchart outlining an exemplary operation of the present invention when transmitting a call received from a wired telephone unit associated with the facility. As shown in **Figure 3B**, the operation  
20 starts with receiving a call from a wired telephone unit in the facility destined for an outside telephone number (step **340**). The format of the call is converted from a wired telephone network format to a wireless network format (step **350**) and the call is transmitted to the  
25 wireless network (step **360**). The call is then routed through the wireless network in a normal fashion until it reaches the destination telephone unit (either wired or wireless).

     Thus, the present invention provides an apparatus  
30 and method by which telephone calls may be routed to wired telephone units via a wireless network without the need for an external wired telephone network. By virtue

of the present invention, wireless calls are routed directly to the facility to which the calls are destined. A converter in the facility then routes the call to an appropriate wired telephone unit. Thus, the facility  
5 owner/operator need only have one telephone service provider, i.e. the wireless telephone service provider. Moreover, the facility owner/operator may make use of many of the financial benefits of wireless networks, such as free voicemail and caller ID services, and reduced  
10 costs due to having a single telephone service provider.

As a further embodiment of the present invention, the functionality of the present invention may be extended such that both wired and wireless telephones may be associated with the facility, and the present  
15 invention may discern when to route calls to the wired or the wireless telephones. **Figure 4** is an exemplary block diagram of a wireless network in accordance with this further embodiment. The elements in **Figure 4** are the same as those in **Figure 1** with the exception that a  
20 wireless telephone unit **190** is associated with the facility **130**.

The wireless telephone unit **190** may be carried by a user outside the location of the facility **130**. In one embodiment of the present invention, calls to a telephone number associated with the converter **120** may be routed to the wireless telephone unit **190** in a similar manner as that described above with regard to **Figure 1**. The difference here is that since the telephone unit **190** is wireless, the forwarding of the call to the wireless  
25 telephone unit **190** does not require conversion of the call to a wired telephone network format. Further, the  
30

call is forwarded using the wireless network **110** rather than the facility wired network interface **230**.

In an alternative embodiment, the wireless telephone service provider **115** may transmit the call to both the

5 converter **120** and the wireless telephone unit **190** rather than relying on the converter **120** to forward the call to the wireless telephone unit **190**. Such functionality requires the wireless telephone service provider **115** to maintain in its database an identifier of the converter  
10 and the wireless telephone unit **190** such that it can transmit a call signal to both units. For example, as single telephone number may have two or more different telephone unit identifiers associated with it, e.g., a first telephone identifier for the converter **120** and a  
15 second telephone identifier for the wireless telephone unit **190**. When a call is placed to the telephone number, the call is routed to both the converter **120** and the wireless telephone unit **190**. The first telephone unit to answer the call will have the call forwarded to it.

20 In yet a further embodiment of the present invention, the wireless telephone unit **190** may be equipped with a location determination device, such as a Global Positioning System (GPS), Loran, or the like. The wireless telephone unit **190** may periodically report its  
25 current position to the wireless telephone service provider **115** which updates the current position in a database.

When a call is received for the wireless telephone unit **190**, the wireless telephone service provider **115**  
30 first checks the last reported current position against a geographical location database to determine whether the

wireless telephone unit **190** is in the same location as the facility **130**. If not, the call is forwarded to the wireless telephone unit **190**. If it is in the same location, the call is forwarded to one of an appropriate wired telephone unit in the facility **130** only via the converter **120**, or both the wired telephone unit and the wireless telephone unit **190**. The decision whether to send to one or the other is purely implementation specific, and may be user selectable.

In these alternative embodiments, the converter **120** is the same as shown in **Figure 2**, however the wireless telephone service provider has additional functionality than that of standard wireless telephone service providers. **Figure 5** is an exemplary block diagram illustrating the primary operational components of the wireless telephone service provider according to these alternative embodiments.

As shown in **Figure 5**, the wireless telephone service provider includes a controller **510**, a memory **520**, a communication interface **530**, a geographical location database **540**, and a wireless unit database **550**. These elements **510-550** are coupled to one another via the control/data signal bus **560**. Although a bus architecture is shown in **Figure 5**, the present invention is not limited to such and any architecture that facilitates the communication of control/data signals among the elements **510-550** may be used without departing from the spirit and scope of the present invention.

The controller **510** controls the overall operation of the wireless telephone service provider and orchestrates the operation of the other elements **520-550**. The

controller **510** may operate based on control programs stored in memory **520**, for example. The controller **510** controls the routing of calls to the wireless telephone units and the converters associated with facilities via  
5 the interface **530**.

The geographical location database **540** stores geographical location information for various facilities registered with the wireless telephone service provider. Such geographical location information may include, for  
10 example, geographical coordinates of the facilities, their identifications, associated telephone numbers, and the like.

The wireless unit database **550** stores information regarding the various wireless units that are currently  
15 under the supervision of the wireless telephone service provider. Such information may include identifications of the wireless units (this includes converters), associated telephone numbers, last reported current geographical locations, and the like.

In one of the alternative embodiments, when a call  
20 is received for a wireless telephone unit, the wireless telephone service provider compares the last reported current location from the wireless unit database **550** to the geographical location information stored in the  
25 geographical location database **540** to determine if the last reported location coincides with the geographical location of the facility with which the wireless telephone unit is associated. If so, the call may be routed to one or more of an appropriate wired telephone  
30 unit in the facility via the converter, and the wireless telephone unit.

**Figure 6** is a flowchart outlining an exemplary operation of a wireless telephone service provider according to this alternative embodiment. As shown in **Figure 6**, the operation starts with receipt of a call 5 destined for a wireless telephone unit associated with a facility (step **610**). The wireless telephone service provider retrieves a last reported current location for the destination wireless telephone unit (step **620**). The last reported current location is then compared to 10 location information in the geographical location database (step **630**). A determination is then made as to whether the wireless telephone unit is in the same location as the facility (step **640**). If not, the call is routed to the wireless telephone unit (step **650**). If so, 15 the call is routed to the converter **120** and thereby to one or more of an appropriate wired telephone units in the facility. The call may also be routed to the wireless telephone unit (step **660**).

Thus the present invention provides a mechanism by 20 which telephone calls may be sent to wired telephones directly from a wireless network without first going through a wired telephone network. While the present invention provides such functionality, this does not preclude the wired telephones from also receiving calls 25 from other wired telephone devices via a wired telephone network. In other words, the present invention may operate in conjunction with wired telephone networks although the present invention itself does not make use of these wired telephone networks.

30 It is important to note that while the present invention has been described in the context of a fully functioning call processing system, those of ordinary

skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions in a variety of forms and that the present invention applies  
5 equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and  
10 transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded  
15 formats that are decoded for actual use in a particular data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the  
20 invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention and their practical application, and to enable others of  
25 ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.